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EQUINE PIROPLASMOSIS IN PANAMA.*

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(WITH PLATE 3.)

The writer discovered recently at Ancon a fatal case of piroplasmosis in an American driving horse. According to Professor Nuttall,¹ who has made an exhaustive study of the geographical distribution of piroplasma, this is the first record of the parasite (*Piroplasma caballi*) in America. The disease, analogous to Texas cattle fever, is very common in parts of South Africa, where it is called biliary fever. According to Bowhill² it was first observed in 1883, by Wiltshire in Natal, who named the malady anthrax fever. Hutcheon, in Cape Colony, described it as biliary fever of the horse. The disease has also been reported from Italy (Guglielmi, 1899), Russia, India, China, and Brazil.

Case history.—The horse was a driving horse (No. 35), one of the first to be sent from the United States to the Canal Zone for the Commission in 1904-5.

On January 7, 1913, he was one of a pair used to carry a party of engineers on an inspection trip to Old Panama and the Juan Diaz River. The trip was made during one day, and at the river the animal was permitted to graze on the Sabannas, where there were some native ponies. Previous to the trip he had been constantly used at Ancon and the city of Panama. The animal continued at work every day until January 11, when he was taken out of the break with symptoms of overheating; temperature was 105-106.2°. The following day the temperature ranged between 102° and 105°. Respirations were labored and the pulse was feeble. On Monday, January 13, the lungs were clear, respirations were rapid, and the pulse very weak. The temperature was 105.2° at 9 A.M., and 106.2° at noon. On January 14, the animal was down, but was able to get up. Respirations were much labored and the conjunctivae were deep yellow in color with large, rather thin ecchymoses; death occurred at 12 noon.

The autopsy was performed at 3:30 P.M. Several ticks were taken from the animal's ear and flank. The animal appeared to have lost considerable weight within the last 24 hours. There was no subcutaneous edema and the cavities were clear. The right lung was congested and edematous; left normal. The right bronchus contained jaundiced mucus. In the left ventricle of the heart there were large, dark red, sub-endocardial ecchymoses. The liver was not appreciably enlarged. On section, its parenchyma was coarse, each lobule slightly separated from its neighbor,

* Received for publication June 27, 1913.

¹ Personal communication to writer.

² *Jour. Hygiene*, 1905, 5, p. 7.

and light grayish brown in color. Near the anterior margin and on the superior surface were large purplish areas of necrosis in which the central and intermediate zones had the hyaline yellow appearance of advanced fatty change. These areas in size varied up to 3 by 1.5 by 1.5 cm., and seemed to surround certain peripheral branches of the hepatic veins. None were seen in the interior. The bile ducts were normal, and contained bile, mucous in character, full of fine black dots.

The kidneys presented nothing of note. The mucosa of the pelvis in each one was covered with jaundiced mucus containing fine black dots like those noted in the bile ducts.

The urinary bladder contained turbid jaundiced urine.

The lymph nodes draining the kidney were not enlarged, or but very slightly so, yet they were intensely red in color.

The adrenals appeared normal.

The spleen was enormously enlarged. Its capsule was smooth, and of a bluish steel color free from ecchymoses. On section, the pulp bulged above the capsule and was very dark in color. Upon scraping, the pulp was removed with ease, leaving a clean gray reticulum showing but the slightest evidences of lymphoid tissue. The malpighian bodies were atrophied. The weight of the spleen was estimated as 28 pounds, and it appeared to be larger than the liver.

The great size of the spleen was the most striking feature of the autopsy, and it is readily seen how Wiltshire named the disease anthrax fever, for the size and consistence of the organ were exactly like those of anthrax of cattle.

Circumstances point strongly to the infection having been contracted from infected ticks obtained at the Juan Diaz River, for this disease has not been detected among the corral horses during the period of the American occupation, altho since 1909 careful blood examinations have been made on many of the animals, and autopsies held on practically all fatal cases of disease.

It is in such a location as Juan Diaz that a corral horse could come into contact with infected ticks from native horses, and we know that piroplasmosis is a tick-transmitted disease, one form in Russia being transmitted by *Dermacentor reticularis* and another in South Africa by *Rhipicephalus evertsi*. Ticks were removed from the horse by hostlers a day or two before the animal fell sick, and at autopsy ticks were collected which were very kindly identified for me by Professor Nuttall and Mr. Warburton as *Dermacentor nitens* and *Amblyomma cajennense*.

The parasite.—There was no gross peculiarity of color noticed in the animal's blood, yet it was hyperfluid, and thin films for staining were made with difficulty. This turned out to be no great

disadvantage in diagnosis, for the non-infected erythrocytes were clumped, leaving the few infected ones free in clear spaces where they could be detected easily. There appeared to be some degree of leukocytosis with a predominance of transitional and mononuclear forms. Eosinophils were not encountered, tho present in good numbers in two non-infected controls. The types of parasites encountered were those described by Nuttall and Strickland¹ as *Piroplasma* (*Babesia*) *caballi*, and, as these observers have noted in their experimentally infected animals, parasites were sparse.

It was seen at once that the parasite belonged to the type *Piroplasma* and not to *Nuttallia* (França 1909). The predominating forms were somewhat oviform. But a number of double pyriform forms were seen also, and a few single pyriform forms as well. Nearly all the forms illustrated by Nuttall and Strickland were found, as well as some dwarfed or attenuated forms (Fig. 10).

Koch, in 1905, stated that he believed that there were two types of parasites in equine piroplasmosis and that they might cause distinct diseases. In 1910, Nuttall and Strickland published the results of their investigations which showed that two distinct species of piroplasma occurred in horses suffering from biliary fever, and later, in 1912, they published a detailed account of their work from which it appears that the disease is caused by two parasites: *Nuttallia equi* Laveran and *Piroplasma* (*Babesia*) *caballi*, Nuttall, 1910.

According to Nuttall and Strickland, França (1909), convinced of the difference between piroplasma and Laveran's parasite, which presented "cross forms," placed the latter parasite in a new genus named *Nuttallia*. The parasites belonging to this genus do not multiply according to the method described for piroplasma. They do not occur as pairs or multiples of pairs of pyriform parasites inside of corpuscles, and they form distinctive "cross forms" which Bowhill and França regard as multiplication forms.

Period of incubation.—Infection by direct inoculation appears to be accomplished with difficulty. Nuttall and Strickland, however, noted the appearance of *Piroplasma caballi* in the blood of experimentally inoculated horses after 8, 10, and 15 days, respec-

¹ *Parasitology*, 1912, 5, p. 65.

tively. In the case reported here, one of natural infection, the period of incubation, assuming as we must that the infection was contracted at Juan Diaz, was four days.

Symptoms.—The symptoms are those of an acute infection, with sudden onset and high fever. The respirations are accelerated and the pulse is weak. Icterus of the visible mucosae is well marked, and the ecchymoses on the conjunctiva would seem to be a common characteristic. Very similar hemorrhages, however, are seen in murrina, the trypanosomal disease of horses of this region. The urine is jaundiced and highly colored, and hemoglobinuria is said to occur in some cases. The duration of the disease would seem to be variable. Some acute cases last only two or three days, in other instances much longer.

The native horses in a region would seem to be more or less immune to the disease. Bowhill's experience led him to believe that this immunity depended upon the animal being reared in an infected area. Imported animals kept separate from native stock, as is usually the case here with Commission animals, may never contract the disease. However, if they are permitted to run in native tick-infested pastures, or on the highly infested trails, it is likely that, as in the case reported here, the disease may present itself and assume serious features. Carini¹ states that among imported horses the disease becomes truly epidemic.

Theiler, according to Bowhill, states that a bipolar-staining bacillus frequently appears as a terminal or associated infecting agent. This is interesting and seems to be analogous to the associated infections by the typhoid-colon group *B. icteroides*, *B. paracolon*, and *B. suipestifer* seen in yellow fever, *Verruga perusna*, and hog cholera.

All the piroplasma exhibit a high specificity for their respective hosts, and *P. caballi* appears to be no exception to this rule.

Transmission.—In Russia, *P. caballi* is transmitted by *Dermacentor reticularius*. It seems likely then that *D. nitens* may be the carrier for *P. caballi* in this region. This tick is known as the tropical horse tick and is distributed throughout Mexico (?), Central America, the West Indies, and southern Texas. The dis-

¹ *Archivo da Sociedade d. Medicina e Chirurgia d. São Paulo*, 1910, 1, p. 2.

tribution of the disease in Panama is being investigated, for, as there is a disease among horses in the interior known as anthrax, there can be no doubt but that equine piroplasmosis is endemic in this region among native animals.

The probable transmitting agent.—*Dermacentor nitens*, the tropical horse tick of America, was described by Neumann in part from specimens taken from horses in San Domingo and Jamaica. In 1901, he listed it from Guatemala, Venezuela, and Porto Rico. It has been taken at Brownsville, Harlingen, and Kerrville,¹ Texas. Newstead² stated that *D. nitens* in Jamaica, 1908-9, was distributed fairly widely over the island, tho not an abundant species anywhere. He stated that it was rare apparently in the United States, but common on horses at San Domingo. Newstead found it almost exclusively confined to horses and mules, chiefly the former, occurring in little colonies inside the ear, altho found in other natural cavities of these animals. This is our experience in Panama, with the modification that mules, from the nature of their work on roads not frequented by native horses, are rarely infested, while saddle horses when used on the trails become infested.

Banks,³ in an interesting and prophetic note on *D. nitens*, states that he has taken this tick at Fort Bowie, Arizona, and that specimens from Haiti were in the Museum of Comparative Zoölogy. In noting morphological features he calls attention to the fact that this tick is strongly separated from all other species of the genus, the stigmal plate and impressed lines behind, with the male, being peculiar and noticeable. The very short palpi, shorter than the hypostome, he states, constitutes a peculiar character again seen in the cattle tick and, as in this species, *may indicate some habit connected with the dissemination of disease.*

Hooker,⁴ states that *D. nitens* is found in Texas from Brownsville to Corpus Christi and passes both molts upon the host, and records⁵ *D. nitens* from Texas, Arizona (?), Guatemala, Costa Rica, Cuba, Jamaica, San Domingo, Porto Rico, and Trinidad.

In Panama, *D. nitens* taken from a native horse at Chorrera

¹ Hunter & Hooker, *Bull.* 72, Bur. Entom., U.S. Dept. Agric., 1907.

² *Ann. Trop. Med. and Parasit.*, 1909, 3, p. 421.

⁴ *Jour. Econ. Entom.*, 1908, 1, p. 47.

³ *Bull.* 15, Bur. Entom., U.S. Dept. Agric., 1908.

⁵ *Ibid.*, 1909, 2, p. 404.

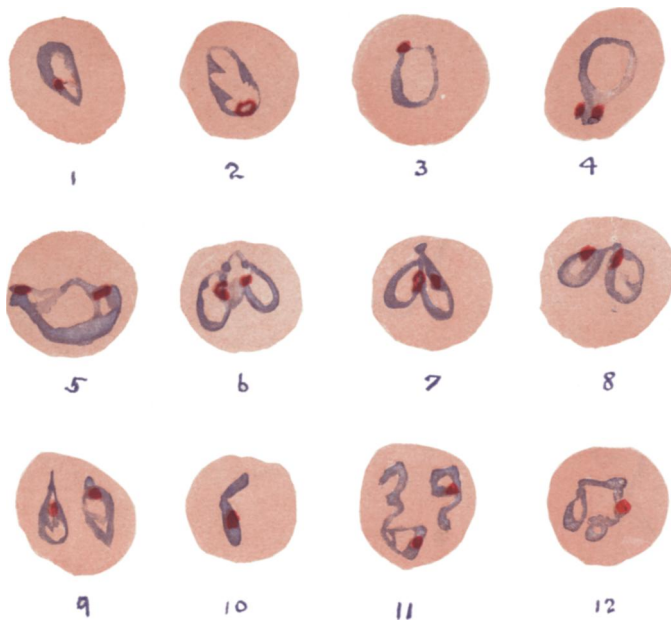
April 9 began ovipositing April 17 and continued each day until April 27, excepting April 23 and 24. Eggs were placed in a sunlit place and began to hatch May 10. All eggs were hatched and larvae began to swarm May 14. They could not under any circumstances be made to attach themselves to, and remain on, guinea-pigs.

Prophylaxis treatment.—The prevention of the occurrence of the disease in the United States requires that prohibition be placed on animals from infected zones entering regions where *D. nitens* is propagated.

Attempts to destroy ticks in a country like Panama are doomed to failure, for, while it might be possible to rid for a time certain pastures of ticks, the trails are simply alive with them.

For a remedy, Nuttall and Hadwen have recommended trypanblau, and according to Yakimoff, the disease has been treated successfully in Russia by Bielitzer with this drug.

PLATE 3.



FORMS OF *Piroplasma caballi* SEEN IN HORSE NO. 35.
Nos. 1-9, inclusive, illustrate phases in the process of subdivision.